



INTELLIGENT POWER PROFILER COMMUNICATOR

*Eco Logger
User manual*

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1 INTRODUCTION

While thanking you for your preference, we kindly require you to read this manual carefully in order to make the best use of the **Eco Logger** unit.

1.1 COPYRIGHT

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1.2 CONFORMITY DECLARATION

Electrex S.r.l.

Via Claudia 96 41056 Savignano s/P (MO)

Declares on its own responsibility that the following product:

Eco Logger

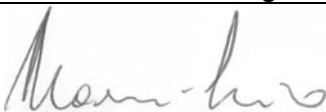
Complies with the regulations in force with reference to the 89/336/EC directive and, in particular, with:

Health and Safety : EN 61010
EMC : EN 61326

Moreover, the product includes the Audiotel Engineering S.p.A. Compact Plus GSM modem complying with the regulations in force with reference to the R&TTE 1999/5/EC directive and, in particular, with:

Radio : 3GPP TS 51.010-1 v. 5.1.0 (12/2002);
: EN 301 511 V9.0.2 (final draft)
EMC : EN 301 489-7 V1.2.1 (08/2002)
Safety : EN 60950:2000

CE 0678

December 2003
Erminio Mazzoni
Technical Manager


1.3 WARRANTY

This product is guaranteed against any material and manufacture defect for a period of 24 months starting from its date of purchase. The warranty will not cover any defect due to:

- Improper and careless use
- Damage caused by atmospheric agents
- Vandalic acts
- Wearing material

Electrex reserves the right to repair or replace defective products at its own discretion. The warranty is deemed to be expired when the failure is caused by improper use or by an operating procedure that is not provided for by this manual.

1.4 RETURN PROCEDURE FOR REPAIR (RMA)

Electrex will **only** accept the returns that have been authorised in advance. If the product has been directly purchased from Electrex, the purchaser shall ask Electrex for the authorisation to return the product for repair by sending a fax or by using the form attached hereto. Alternatively, the purchaser shall ask for assistance at the point of sale where it purchased the product. The following information shall be supplied in both cases:

- The purchaser's trade name and personal data;
- Person of reference;
- Product description;
- Serial number;
- Description of any accessory included with;
- Invoice / Document of Transport number and date;
- Detailed description of the malfunction and configuration in use at the time of the failure.

The Electrex repair laboratory, which will be contacted by the point of sale or by the final customer (only in case of a direct sale), will issue an RMA number to be written by the point of sale / customer on the package and on the Document of Transport (DDT).

ATTENTION: If the RMA number is not written on the external package, the warehouse is authorised to reject the goods at the consignor's expenses. The material shall be shipped **CARRIAGE FREE** (to the customer's charge) to the following address not later than 15 working days after the RMA assignment:

Electrex S.r.l.
Via Claudia 96 41056 Savignano s/P (MO) ITALY
Atn Service Dept

Electrex shall be returned the under-warranty product in its **original package**.

1.4.1 SHIPPING THE PRODUCTS RETURNED TO THE CUSTOMER

The product that was returned and repaired is shipped **CARRIAGE FORWARD** (to the customer's charge) to the customer. If a product **IS NOT COVERED BY WARRANTY** and it proves to be properly working when it is checked by our technical personnel, the customer will be charged **40 EURO + V.A.T.** on a lump sum basis for check and re-test.

1.4.2 RMA ENCLOSURE

Request for a return authorisation number

Date:	
Company	
Person of reference:	
TEL:	FAX:
Product description:	
Serial number:	
Description of any accessory included with:	
Document of Transport number and date: ATTENTION!! The evidence for warranty is to the customer's charge: if this field is not filled in, the product is not considered to be under warranty.	
Detailed description of the malfunction and configuration in use at the time of the failure:	

<input type="checkbox"/> Tick off for a quotation
If a product IS NOT COVERED BY WARRANTY and it proves to be properly working when it is checked by our technical personnel, the customer will be charged to pay 40 EURO + V.A.T. on a lump sum basis for check and re-test.

Space reserved for ELECTREX's answer:

R.M.A. N.

The RMA number shall be written on the external package and on the Document of Transport (DDT). Otherwise, the ELECTREX warehouse is authorised to reject the goods.

2 GENERAL INFORMATION

2.1 PACKING CONTENT

- Installation manual (this manual)
- The Eco Logger product
- External antenna

2.2 Safety

This instrument has been manufactured and tested in compliance with IEC 1010 class 2 standards by observing the VDE 0110 group B insulation standards for operating voltage values lower than or equal to 250 VACrms phase neutral.

In order to keep these conditions and provide for a safe use, the user shall follow the instructions and indications given here below:

After having received the instrument, make sure it is intact and it has not been damaged during transportation before providing for its installation.

Make sure that the operating voltage and the mains voltage are perfectly identical and then start installing the instrument.

The instrument power supply shall not be grounded.

The instrument is not equipped with any protection fuse on the power supply. It shall be therefore protected by the installer.

Maintenance and/or repair operations may be only carried out by qualified and authorised personnel.

If you should suspect that the instrument is no longer safe, set it out of work and make sure it will not be inadvertently used.

The operation is no longer safe when:

- 1) The instrument shows clearly visible damages.
- 2) When the instrument is no longer working.
- 3) After having stored it in unfavourable conditions for a prolonged period of time.
- 4) If it has been seriously damaged during transportation.

The Flash shall be installed in compliance with all local regulations.

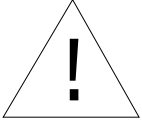
2.3 The operators' safety

Attention: The non-observance of the following instructions may cause a danger of death.



- Dangerous voltage values may be applied on the instrument terminals as well as through voltage and current transformers during normal operations. Current and voltage transformers may generate lethal voltage values if the primary is energised. Follow standard safety precautions when carrying out any installation or service activity.
- The instrument shall be protected by a unit that can disconnect both the power supply and the measuring terminals, that can be easily reached by the operator and well identified as a disconnecter.
- The instrument and its connections shall be properly protected against any short-circuit.

Precautions: The non-observance of the instructions may persistently damage the instrument.



- The instrument is not protected by fuses. As a consequence, protections shall be external.
- Outputs and options are low-voltage and they can not be supplied by any external voltage that is not specified.
- The application of non compatible current levels on current inputs may damage the instrument.

2.4 TECHNICAL FEATURES

2.4.1 PHYSICAL FEATURES

Sizes	200x150x80 mm.
Weight	0.5 Kg
Operating temperature	From -10°C to +55°C
Humidity	From 0 to 95% non condensing
Case	Plastic 120° IP54

2.4.2 EXTERNAL CONNECTIONS

External antenna plug	SMA female connector
Cable gland	2 x PG13

2.4.3 MAIN FEATURES

Primary power supply	80-264Vac 50/60Hz 100-300 Vdc	
Functional compatibility	GSM 900-1800 MHz	
Antenna impedance	50Ω	
RF power	Class 4 (2W) @900MHz Class 1 (1W) @1800MHz	
Consumption	Stand-by	2VA
	GSM operating at the maximum power	6.6VA
Measuring section	Voltage inputs	500 Vrms phase-phase (peak factor max 1.7)
	Current inputs	5 Arms (peak factor max 1.7)
	Frequency	45÷65 Hz
Accuracy	Class 2 on the active energy according to CEI EN 61036	

2.4.4 CONNECTIONS

Inputs	3 Voltage max. 250 Vac phase neutral 3 Current max. 6 Aac on shunt from external CT (max. 4000/5 CT)
SIM	Plug-in type

2.4.5 GSM PERFORMANCES

SMS	MT/MO/CB/PDU mode
DATA	Asynchronous GSM data transmission mode, non transparent mode (2400 / 4800 / 9600 bit/s), CSD up to 14.4 Kbps, USSD, V.110

3 UNIT DESCRIPTION

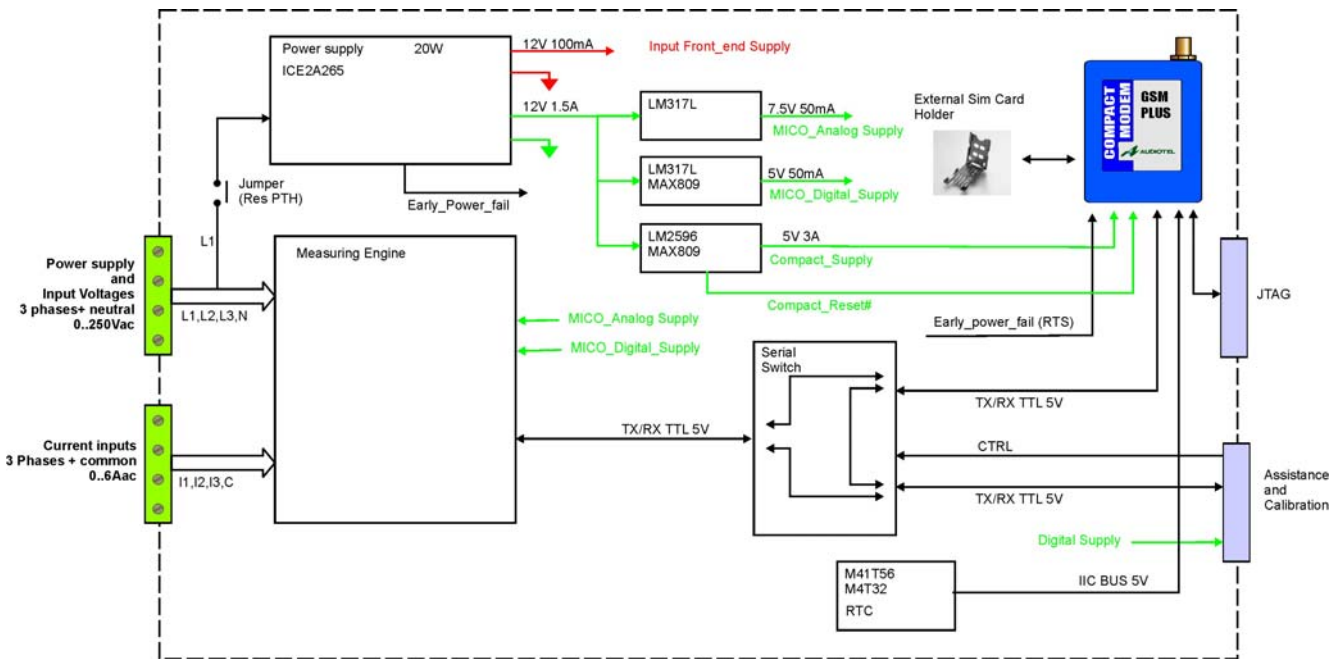
3.1 DESCRIPTION

The Eco Logger is the ideal solution for storing the load profiles in small- and medium-sized companies and for transmitting them to a control centre.

The product is made up by a plastic case for outdoor use, including:

- The electronics
- The GSM module

The following block diagram is intended to represent the whole product:



3.2 Electronics

It is made up by a card with three functional blocks:

- Measuring engine
- Power supply unit
- MODEM

The measuring engine is intended to convert the three voltage and current signals into an energy measurement with a class 2 accuracy degree according to IEC EN 61036.

The power supply unit includes the circuitry to supply the whole electronics from the voltage input (phase 1 and neutral).

The modem is the Audiotel Engineering S.p.A. Compact Plus GSM type. It integrates the access functions to the GSM network as well as the unit control intelligence.

It is complete with an antenna connection as well as a plug-in SIM card reader.

3.3 FUNCTIONALITY AND FIELD OF APPLICATION

The Eco Logger is equipped with three inputs for direct voltage measurement in low voltage and three inputs for current measurement via external .../5 CTs in 4 wire (star)

It stores active and reactive power demand load profile for up to 60 days with programmable integrating time (default 15 min.).

4 FRONT VIEW



View of the internal electronics



View of the inner protection panel

5 INSTALLATION

5.1 WARNING

The product may be only employed for the use for which it has been conceived and manufactured. Any other use shall be considered on the user's sole responsibility.

Commissioning may only occur after the product has been correctly installed. As a consequence, the user shall carefully carry out all the operations described in the manual supplied with the product.

Electrex will disclaim all responsibility for any failure, breakdown, accident, etc. due to the lack of knowledge or observance of any instruction. The same applies for any non-authorized change.

ELECTREX reserves the right to modify the product for any constructive or commercial need. It is not obliged to update reference manuals promptly.

The Eco Logger makes use of the GSM standard for cellular telephony. As a consequence, it can be used within the system coverage areas of a compatible GSM operator.

The GSM system is a radiofrequency technology (RF), Therefore it may interfere with the operation of any other electric unit or it may compromise the operation of electronic units.

The antenna mounted on the product shall be installed in a free space, at a distance of at least 2 metres away from any electric or electronic unit. When these requirements can not be fulfilled, it is recommended to move the antenna to another place and connect it to the unit by means of a coaxial cable with proper characteristics.

The user shall observe the regulations in force. In particular, it is forbidden to use the Eco Logger product:

- On aircrafts.
- In hospitals and nursing centres.
- In proximity of fuel stations or area at risk of explosion.
- In places where chemical agents in general are in use and by paying special attention to the safety rules for environments saturated (or potentially saturated) with volatile gases or fumes.
- In places where detonation operations are carried out.
- In proximity of electromedical units, including personal auxiliary systems, such as: pacemakers and electroacoustic units (hearing aids).
- In places with a high degree of humidity.

5.2 INSTALLATION

The Eco Logger is supplied with a wall-mount plate.

The point of installation shall allow the access to the front panel.

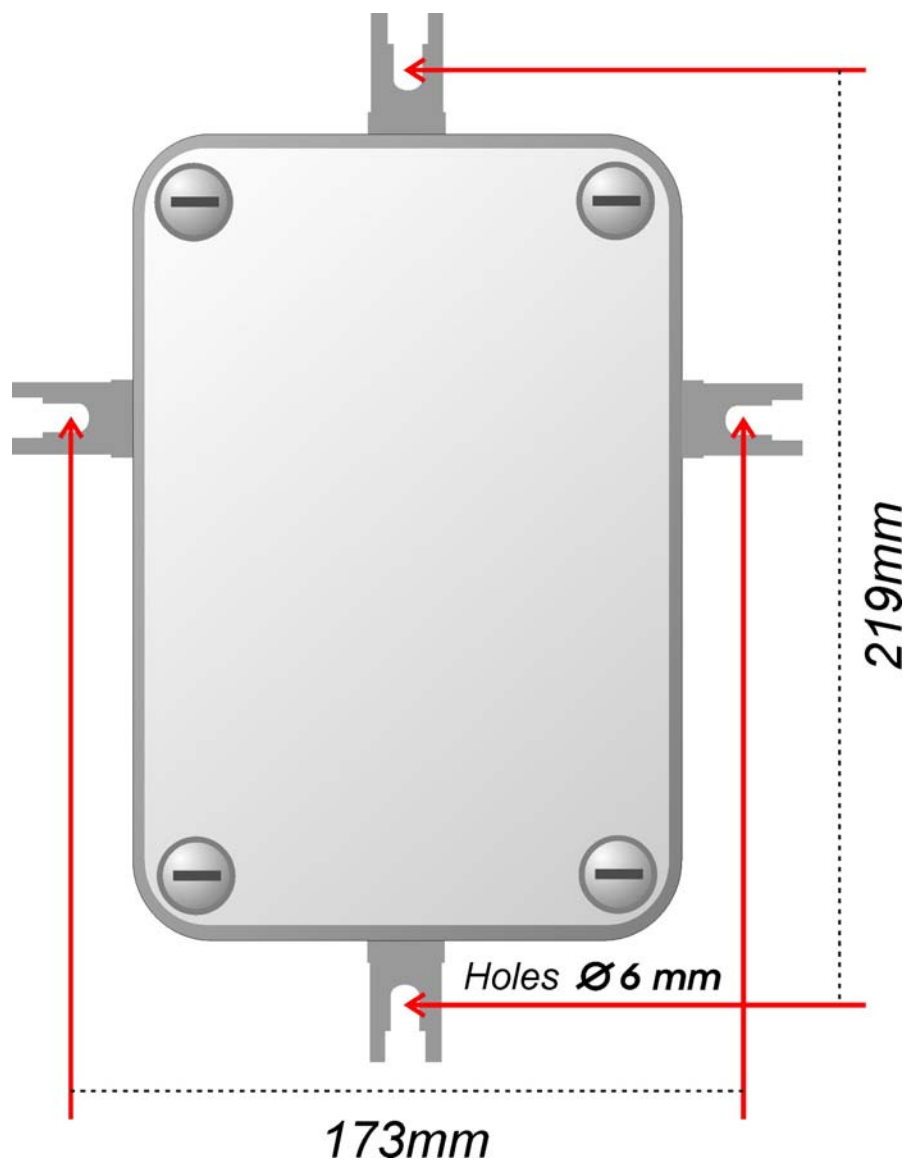
It is recommended to choose a position with the antenna turned upwards.

Select a point of installation with the presence of a proper field strength of the GSM network. (Use a cellular phone equipped with the SIM card of the same operator you wish to use for the unit and check the presence of a field with at least three marks).

Avoid humid position or, anyway, any position that may expose the unit to liquids.

5.2.1 Wall mounting

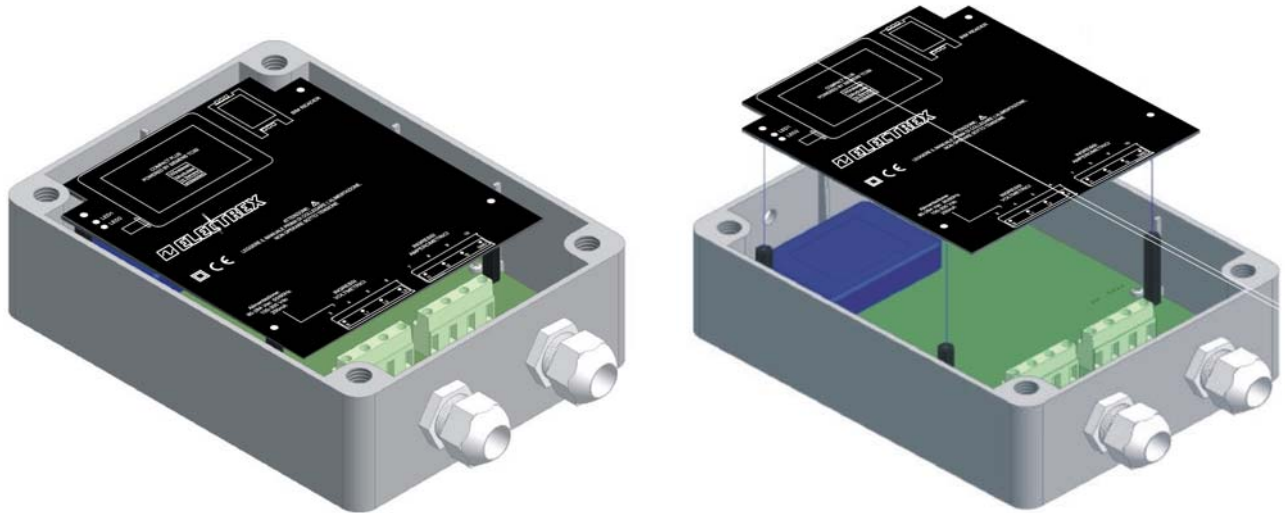
Use four plastic expansion plugs according to the following drawing:



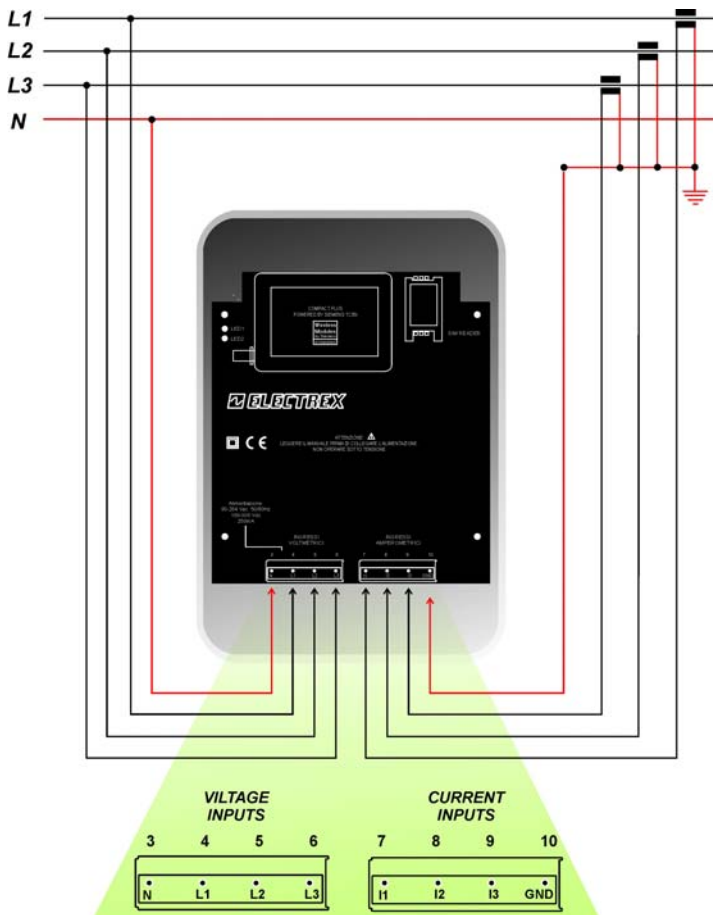
6 CONNECTION

6.1 Inputs

Open the enclosure. Unscrew the 4 screws to have access to the connection terminals.



For better access the panel protecting the circuit, may be removed.



WARNING: The connection cables shall be protected by a four-pole switch that can be easily identified and switched of to make sure that the conductors are not live.

The unit is internally protected against any short-circuit. An external protection shall be arranged to protect the cables and the varistor.

The power supply is internally connected in parallel with the signal of phase 1.

6.2 Antenna

The Eco Logger shall be fitted with an antenna, suitable for operation within the 890-960 MHz and 1710-1880 MHz frequency bands and with a 50Ω nominal impedance.

The antenna shall be installed at least 2 m. away from any electric and electronic equipment in the environment and at least 15 cm. away from any obstacle. It shall be arranged so as to ensure a good reception of the radio field. When these requirements can not be fulfilled, it is recommended to move away the antenna by means of a coaxial cable with proper characteristics.

Assemble the antenna supplied on the SMA connector available on the case by screwing it firmly without forcing.

If the signal is insufficient, use an antenna that is properly mounted and connected to the product by means of a 50Ω coaxial cable terminated by a SMA connector.

Avoid bending the coaxial cable with radii of curvature below 4 cm.

Contact Electrex to choose the antenna.

Never hold the antenna in your hands when the unit is being used. This may compromise the connection quality as well as require the Eco Logger to increase the transmission power.

Never use the product if the antenna is visually damaged. In this case, replace it without delay. It is recommended to use the antennas prescribed by ELECTREX.

6.2.1 Installing the SIM card

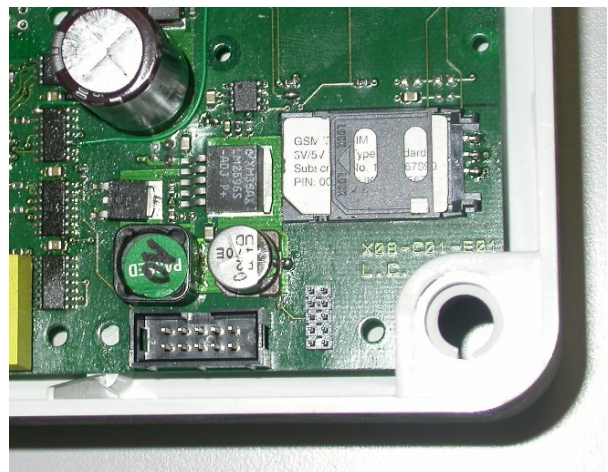
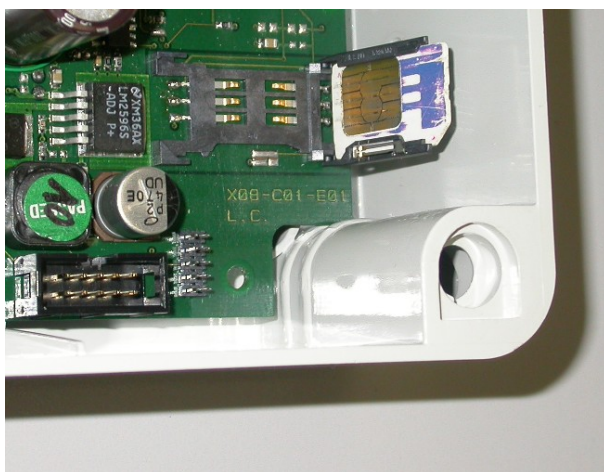
The unit shall be equipped with a SIM card enabled for the DATA transmission service.

Rechargeable SIM cards may be also used.

Insert and extract the SIM card when the unit is powered off.

Follow the steps here below:

1. Open the SIM card reader next to the modem.
2. Turn the SIM card downwards and insert it into the corresponding SIM card reader, as it is shown by the figure.



7 INSTRUCTIONS FOR USE

7.1 Powering on

The Eco Logger has no ON-OFF switch because it is self powered by the network that is being monitored.

When powered on, LED1 (red led) and LED2 (green led) turn on to indicate the presence of the primary supply and the unit operation.

LED 1 indicates the connection status of the GSM modem according to the following table:

LED1 STATUS (Red Led)	Description
Off	Modem off or in sleep mode.
600ms On 600ms Off	No SIM card inserted, no PIN entered, search for the network in progress, user authentication in progress or network login in progress.
75ms On 3s Off	Logged into the network, No call in progress
Permanently on	Data call: during an active connection or a parameter exchange when establishing or disconnecting a call

LED 2 indicates the Eco Logger operation status according to the following table:

LED2 STATUS (Green Led)	Description
400ms On 400ms Off	GSM modem initialisation (at the power on only)
100ms On 100ms Off	Eco Logger initialisation and/or configuration error
Permanently on	Eco Logger operating correctly

7.2 Powering off

The Eco Logger can be powered off by an external switch only.

7.3 Recognizing the main abnormal conditions

The unit may present some abnormal operating conditions that can be recognized.

PROBLEM: after having powered on the unit, LED1 and LED2 are off.

CAUSE: the main power supply line is not connected to the unit. No voltage is applied onto the main power supply line.

7.4 Local maintenance

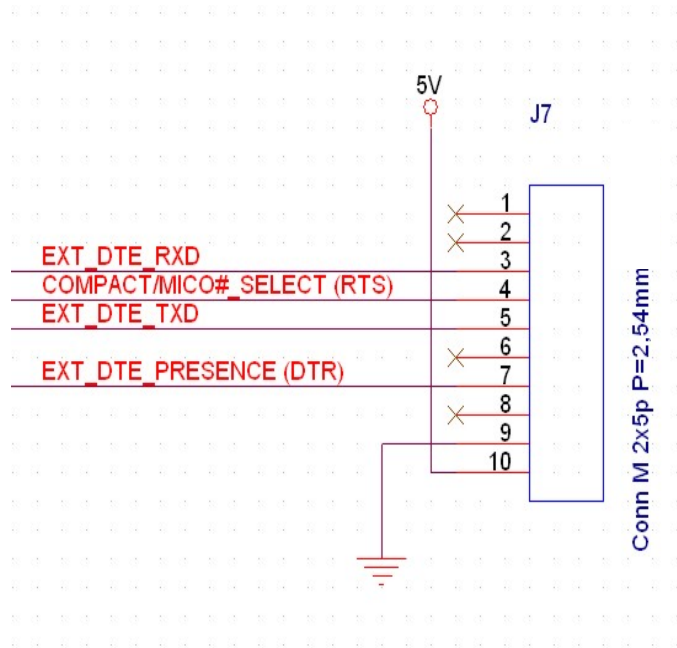
A 10-pole connector is available inside the Eco Logger. It can select the signals of the serial ports of the modem or of measuring part, at TTL level.

It is possible to dialogue with both components by means of the corresponding software units.

The GSM modem uses an AT commands protocol. It is possible to communicate with Iper Terminal, or similar, with a 9600, 8, N, 1 speed rate.

The measurement part uses (in this direct connection only) a ModBus RTU protocol, requiring a specific communication program.

Only personnel that is trained and authorized by Electrex is authorized to the use of this port.



Connect the TTL/RS232 converter with EcoLogger. Set the DTR signal to OFF. The RTS signal is intended to control the type of connection to be set up:

- RTS OFF - Connection with the Compact-Plus inside the EcoLogger
- RTS ON - Connection with the measuring engine inside EcoLogger

To restore the operating connection between measuring and Compact-Plus, set the DTR signal to ON or physically disconnect the TTL/RS232 converter from the EcoLogger.

7.5 Configuration

The Eco Logger unit is delivered with a default programming. Its configuration can be customised both locally and remotely.

Attention: the unit shall be considered as ready for use on these conditions, however, it will not operate properly because some specific site parameters need to be customized.

The unit can be remotely configured by using a GSM modem with proper SIM cards.

The remote computer shall be configured according to the following parameters:

Baud rate 9600

No. of bits 8

Parity None

Stop bit 1

After powering on the unit, carry out the following operations by using a communication programme (e.g. HyperTerminal).

7.5.1 Programming the local clock

Type the following command. Then press Enter:

AT#RTC=yyyy,mm,dd,dwe,hh,mn,sc (e.g. AT#RTC=2003,12,02,tue,13,30,00)

Where:

yyyy= year

mm= month in digits

dd= day

dwe= the first three letters of the day name in English

mn= minute

sc=second

Note: When the Eco Logger is delivered, its clock time is programmed with reference to the manufacturer's time zone.

7.5.2 Checking the GSM signal level

The GSM signal level as well as the registration status may be checked from the unit by using the following commands:

AT+CSQ (Enter)

The GSM module answers as follows:

+CSQ: <rss>, <ber> OK

The fields have the following meaning:

<rss>	level received
0	-113dBm or below
1	-111dBm
2 - 30	From -109 to -53dbm
31	-51dBm or above
99	not measurable

<ber>	Bit error rate
0 - 7	0= very good 7= very bad
99	not measurable

It is recommended to operate with a “rss” level above 14 and with a “ber” level below 2 to enable the unit to operate properly.

The GSM operator you are connected with may be detected by typing the following command:

AT+COPS? (Enter)

The GSM module answers as follows:

+COPS: <mode>[, <format>[, <oper>]] OK

The fields have the following meaning:

<oper> operator's name in the same format as <mode>

<mode> 0 automatic mode; the <oper> field is ignored

1 operator's manual selection; the <oper> field is available

2 manual deregistration

3 available in writing mode only

4 automatic selection with priority to mode 0

<format> 0 alphanumeric format for the <oper> field (max 16 characters)

1 numeric format for the <oper> field (GSM Location Area Identification number)

After having provided for the local configuration, the unit may be closed. The control centre will perform all the other programming operations through the GSM network.

8 COMMANDS

8.1 Introduction

The unit is compatible with the commands described here below:

8.2 Profiles

The unit can manage a CID (Caller Identifier Database) containing a list of the authorised calling numbers and their access profile.

The unit handles two access profiles:

- 1 - 'Maintainer'
- 2 - 'User'

The 'Maintainer' or the 'User' profiles can only be used if the incoming CID is recognised as valid and included in the indust.cid file. The caller will qualify as a 'Maintainer' or as a 'User' according to the password entered in the login phase.

The 'Maintainer' profile is only allowed to update the firmware of the unit.

The 'User' profile can modify the content of the indust.cid and indust.ini file.

Two passwords are managed: one for the 'Maintainer' profile and one for the 'User' profile. Their length is ranging between seven and fifteen alphanumeric characters.

The 'User' profile can only read the files including the data files i.e. the measurement data recorded in the memory.

Note: There is no file protection in the local connection.

8.3 Login phase

The unit will only answer if the incoming CID is recognised as valid and listed among the programmed ones.

The unit will answer with the following message:

```
Eco Logger fw ver. 1.00 2004/03/15 12:12:12  
Enter Password:
```

The user has got 30 sec. to enter its own password. Afterwards, the call is automatically terminated.

The following message is displayed in case of error:

```
Password Error  
Enter Password:
```

Max two password re-entries are allowed. The call is automatically terminated after the third error.

After the password is correctly entered, the unit answers by means of a string indicating the type of connected user:

‘Logged as User’ if connected with the User profile,
 ‘Logged as Maintainer’ if connected with the Maintainer profile,

8.4 Password management commands

Two passwords are available: one to identify the ‘Maintainer’ users and one to identify the ‘User’ users.

‘User’ and ‘Maintainer’ users can read / modify their own password only.

The default configuration profile can provide for the set-up of pre-defined passwords for “User” and “Maintainer” users.

8.4.1 AT#USERPWD “User” Password Management	
AT command used to read/set up the password of “User” users	
Write command AT#USERPWD =<new_pwd>,< new_pwd>	Response OK Parameter <new_pwd> New password to be set up, the command input arranges that <new_pwd> is entered twice. The password length shall be higher than or equal to 7 and it shall be lower than or equal to 14.
Example	AT#USERPWD=user0123,user0123 OK
Read command AT#USERPWD	Response OK Parameter None
Reference Audiotel	Note Command available in the Local and the Remote mode. Enabled users: User
Example	AT#USERPWD USERPWD=user0123 OK

8.4.2 AT#MAINTPWD “Maintainer” Password Management

AT command used to read/set up the password of “Maintainer” users

Write command AT#MAINTPWD=<new_pwd>,<new_pwd>	Response OK Parameter <new_pwd> New password to be set up, the command input arranges that <new_pwd> is entered twice. The password length shall be higher than or equal to 7 and it shall be lower than or equal to 14.
Example	AT#MAINTPWD=maint0123,maint0123 OK
Read command AT#MAINTPWD	Response OK Parameter None
Reference Audiotel	Note Command available in the Local and the Remote mode. Enabled users: Supplier and Maintainer
Example	AT#MAINTPWD MAINTPWD=maint0123 OK

8.5 File management commands

The file system implemented in the Eco Logger provides for one single directory root and for file names having a maximum length of 80 characters.

For safety reasons not all files are visible to the various users.

‘User’ users can:

- modify/read the indust.cid and indust.ini file
- read/delete the report files

‘Maintainer’ users can:

- write/read the INDPLUS.OS7 firmware file

8.5.1 AT#DEL Deleting a file

AT command used to delete a file available in the file system.

Write command AT#DEL=<file_name>	Response OK Parameter <file_name> Name of the file which have to be deleted. The file name is case sensitive. Maximum file length is 80 characters.
Reference Audiotel	Note Command available in the Local and the Remote mode. Enabled users: all Some types of files might not be erased by the current user.
Example	AT#DEL=test.txt OK

8.5.2 AT#DIR Directory list

To display the files available in the file system.

Read command AT#DIR	Response <pre> ----- 1 ews ews <file_length> Jan 1 10:12 <file_name1> ----- 1 ews ews <file_length> Jan 1 10:12 <file_name2> ... ----- 1 ews ews <file_length> Jan 1 10:12 <file_nameN> OK <file_length> file length in bytes expressed in a decimal format with filling spaces. <file_name> file name. The file name is case sensitive, the maximum length is 80 characters. Parameter None </pre>
Reference Audiotel	Note Command available in the Local and the Remote mode. Enabled users: all
Example	<pre> AT#DIR ----- 1 ews ews 3873 Jan 1 10:12 industrial.jpg ----- 1 ews ews 7868 Jan 1 10:12 indust-io.jpg ----- 1 ews ews 3197 Jan 1 10:12 industrial.htm ----- 1 ews ews 119 Jan 1 10:12 indust.cid ----- 1 ews ews 242 Jan 1 10:12 indust.ini Free space: 1504768 OK </pre>

8.5.3 AT#FILEATTR Reading / Modifying the attributes of a file

To read / modify the file attributes inside the file system. Each file includes a series of bits intended to specify the operations the various users can execute.

“User” and “Maintainer” users automatically set up their rights for each file they are intended to define. They can not use this command.

Only “Supplier” users can read/set up the attributes of each file available in the file system.

The attributes are stored in a 4-bit mask that is organised as follows:

- bit0 rights to read for “User” users
- bit1 rights to write / delete for “User” users
- bit2 rights to read for “Maintainer” users
- bit3 rights to write/delete for “Maintainer” users

Each bit is intended to activate the rights specified above when it is set to 1.

Write command AT#FILEATTR= <file_name>,<file_attr>	Response OK Parameter <file_name> Name of the file, the attributes of which shall be modified. The file name is case sensitive, the maximum length is 80 characters. <file_attr> each digit from 0 to F, it is the representation of the attributes to be set up according to the mask above.
Reference Audiotel	Note Command available in the Local and the Remote mode. Enabled users: Supplier
Example	Set-up of the rights to read/write for “User” users for the “file.ini” file AT#FILEATTR=file.ini,3 OK
Read command AT#FILEATTR= <file_name>	Response #FILEATTR: <file_attr> OK <file_attr> each digit from 0 to F, it is the representation of the file attributes according to the mask above. Parameter <file_name> Name of the file, the attributes of which shall be read. The file name is case sensitive, the maximum length is 80 characters.
Reference Audiotel	Note Command available in the Local and the Remote mode. Enabled users: Supplier
Example	AT#FILEATTR=file.ini #FILEATTR: 3 OK

8.5.4 AT#FORMAT Formatting the file system

This command is used to format the file system, i.e. to delete all files completely. It is recommended to restrict its use.

Write command	Response
AT#FORMAT	OK
	Parameter
	None
Reference	Note
Audiotel	Command available in the Local and Remote mode. Enabled users: Supplier
Example	AT#FORMAT OK

8.5.5 AT#READ XMODEM reading of a file

Command intended to transfer a file from the EcoLogger to DTE. The protocol in use is XMODEM or XMODEM-1K. After having typed the AT#READ command and pressed the Enter key, DTE shall start an XMODEM or XMODEM-1K reception procedure. The Ctrl-X character can be used to interrupt the transfer procedure.

The package size can be 1K by specifying the AT#READ command or 128 bytes by specifying the AT#READC command.

The error control type is selected by DTE (for example, HyperTerminal is always using 16-bit CRCTT).

Read command	Response
AT#READ=<file_name>	File length: <file_length> XMODEM Transmission started
	<file_length> File length in bytes.
	Parameter
	<file_name> Name of the file to be read. The file name is case sensitive, the maximum length is 80 characters.
	Note: the size of each package is 1K
Read command	Response
AT#READC=<file_name>	As above
	Parameter
	As above
	Note: the size of each package is 128 bytes
Reference	Note
Audiotel	Command available in the Local and the Remote mode. Enabled users: all
Example	AT#READ=file.ini File length: 444 XMODEM Transmission started

8.5.6 AT#TAIL Reading a text file

To show the content of a text file.

Write command	Response
AT#TAIL=<file_name>	<text_file_content> OK Parameter <file_name> Name of the file to be read. The file name is case sensitive, the maximum length is 80 characters. file_content Content of the file mentioned above
Reference	Note
Audiotel	Command available in the Local and The Remote mode. Enabled users: all
Example	AT#TAIL=test.txt This text is contained into the text file named test.txt OK

8.5.7 AT#WRITE XMODEM writing of a file

Command intended to transfer a file from DTE to the EcoLogger by using the XMODEM or XMODEM-1K protocols. After having typed the AT#WRITE command and pressed the Enter key, DTE shall activate an XMODEM procedure intended to send a file. The Ctrl-X character can be used to interrupt the transfer procedure. The error control type can be selected by specifying the 'C' suffix. Use AT#WRITE to select the 16-bit CRCTT error control. Use AT#WRITEC to select the 8-bit checksum.

The package size is selected by DTE. It can be 128 bytes or 1K byte.

Write command	Response
AT#WRITE=<file_name>,<size>	Expected file length: <file_length> XMODEM Receive started <file_length> File length in bytes, as it is declared in the command parameter Parameter <file_name> Name of the file to be written. The file name is case sensitive, the maximum length is 80 characters. <size> Length (in bytes) of the file to be transferred. Note: the 16-bit CRCTT error control is used.
Write command	Response
AT#WRITEC=<file_name>,<size>	As above Note: the 8-bit checksum error control is used.
Reference	Note
Audiotel	Command available in the Local and The Remote mode. Enabled users: all
Example	AT#WRITE=file.ini,1124 Expected file length: 1124 XMODEM Received started

8.6 Commands to read the current day periods

The following commands extract the current day load profile periods not yet saved on a file report.

8.6.1 AT#PERIODS Number of day-saved periods	
To show the number of periods that have been saved within the span of a day, starting from 00:00	
Read command AT#PERIODS	Response #PERIODS: <number_periods> OK <number_periods> number of periods that have been saved within the span of a day, starting from 00:00. The number is expressed in a decimal format. Parameter None
Reference Audiotel	Note Command available in the Local and The Remote mode. Enabled users: all
Example	AT#PERIODS #PERIODS: 10 OK
8.6.2 AT#DAYPERIODS To show the counters relative to day periods	
To show the records including the time and counter relative to each period that has been saved within the span of a day, starting from 00:00	
Read command AT#DAYPERIODS=<input>	Response #30 <hour_period> <time_diff> <counter> #30 <hour_period> <time_diff> <counter> ... #30 <hour_period> <time_diff> <counter> OK <hour_period> time, at which the period has expired, and indication of the difference compared to the GMT time. <time_diff> time of deviation from the GMC clock (not available inside EcoLogger) <counter> number of 1/100 of kWh's that have been measured within the period, number expressed in a hexadecimal format. Parameter <input> to specify the type of measurement for submission: 3 active energy 4 reactive energy
Reference Audiotel	Note Command available in the Local and The Remote mode. Enabled users: all
Example	To read the current day periods of the active energy AT#DAYPERIODS=3 #30 22:15:00+01:00 +00:01:29 1178 #30 22:30:00+01:00 +00:01:29 1177 #30 22:45:00+01:00 +00:01:29 1177 OK

8.7 MODBUS

It is possible to send MODBUS ASCII packages within a remote maintenance session so as to convert them into RTU and forward them to the measurement engine inside the unit.

The address field of the MODBUS packages to be sent to the EcoLogger shall be set to 27.

EcoLogger can recognise MODBUS packages when no AT command has been started.

The MODBUS package is opened by sending the " : " character and it is closed by receiving the couple of CR (Carriage Return, ASCII 13 code) and LF (Line Feed, ASCII 10 code) characters.

The EcoLogger never produces the echo of a MODBUS package, not depending upon the current set-up.

The EcoLogger sends the package it received to the measurement engine and it waits for a response package for 10 seconds. The response package is converted into ASCII and forwarded to remote DTE.

If the wait timeout should expire without receiving any answer, the EcoLogger sends remote DTE a package, the address of which is set to 27 and the <function-code> of which is equal to the <function-code> that has been sent by DTE where bit 7 is set to 1 and the <date> field is set to 0x0B.

The <date> field is used to signal the exception code associated with the type of error that is detected in this situation. The 0x0B code corresponds to "*Gateway target unit failed to respond*".

If the MODBUS package is not valid for any reason whatsoever (non hexadecimal characters, LRC not correct, etc.), the EcoLogger will not answer.

8.7.1 :<MODBUS-Packet> Sending MODBUS packages to the measurement engine

It is intended to convert and forward the measurement engine a MODBUS ASCII package it has received from remote DTE. It will wait for a MODBUS RTU package from the measurement engine for 10 seconds. It will convert it into ASCII and send it to remote DTE.

<p>Write command</p> <pre>:<addr><func><date><lrc><end></pre>	<p>Response</p> <p>If the measurement engine should answer within 10 seconds:</p> <pre>:<addr><func><date><lrc><end></pre> <p>(Package from the measurement engine)</p> <p><addr> package address field <func> function code <date> date field <lrc> Longitudinal Redundancy Checking (LRC). Calculated by EcoLogger during the conversion from RTU to ASCII <end> package end, it is composed by the couple of CR (Carriage Return, ASCII 13 code) and LF (Line Feer, ASCII 10 code) characters</p> <p>If no package has been received from the measurement engine within 10 seconds:</p> <pre>:<addr_err><func_err><date_err><lrc><end></pre> <p><addr_err> package address field, always set to 0x1B <func_err> error function code, corresponding to the <func> code of the package it has received from DTE where bit7 is set to 1. <date_err> date field used to communicate the exception code, set to 0x0B corresponding to "Gateway target unit failed to respond". <lrc> Longitudinal Redundancy Checking (LRC). Calculated by EcoLogger during the conversion from RTU to ASCII <end> package end, it is composed by the couple of CR (Carriage Return, ASCII 13 code) and LF (Line Feer, ASCII 10 code) characters</p> <p>Parameter</p> <p><addr> package address field <func> function code <date> date field <lrc> Longitudinal Redundancy Checking (LRC). Calculated by EcoLogger during the conversion from RTU to ASCII <end> package end, it is composed by the couple of CR (Carriage Return, ASCII 13 code) and LF (Line Feer, ASCII 10 code) characters</p>
<p>Reference</p> <p>Audiotel</p>	<p>Note</p> <p>Command available in the Remote mode. Enabled users: all</p>

8.8 Editing the configuration

8.8.1 AT#CONF Editing the configuration file

Command intended to consult and to modify the configuration parameters inside the indust.ini file.

Read command AT#CONF	Response [SYSTEM] BAUDRATE=<baudrate> ECHO=<echo> RESET=<reset> OK Parameter None
Write command AT#CONF=<item1> =<value1>,...,<item 4>=<value4>	Response OK Parameter <baudrate> Speed in bits per second ranging from 300 to 115200, to set up the engine port and the external port speed. Selectable speeds are listed here below: <ul style="list-style-type: none"> • 300 • 600 • 1200 • 2400 • 4800 • 9600 • 19200 • 38400 • 57600 • 115200 <echo> “0” to disable the echo of the command interpreter, “1” to enable it. <reset> Decimal number (0..65535) intended to specify the period (in minutes) required to re-initialise the communicator. The default value is 720 minutes (12 hours). Re-initialisation may only occur if no call is active.
Example	Baudrate set to 115200 and echo enable AT#CONF=BAUDRATE=115200,ECHO=1 OK
Reference Audiotel	Note Command available in the Local and the Remote mode. Enabled users: Supplier and User

8.8.2 AT#CID Managing the List of Enabled Callers

AT command used to read/set up the list of the calling numbers enabled to activate maintenance calls.

The indust.cid file includes the [CLIP] section with a possible series of fields from NUM01 to NUM99, each one including a phone number that will be enabled to activate maintenance calls. Numbers may be indifferently expressed in an international or national format.

Example for the content of an indust.cid file:

```
[CLIP]
NUM01=3351234567
NUM02=3291234567
NUM03=3471234567
```

The indust.cid file can be edited by this command or loaded by the AT#WRITE command from the outside.

<p>Read command AT#CID</p>	<p>Command used to show the content of the indust.cid file.</p> <p>Response</p> <p>[CLIP]</p> <p>NUM01=<ph.num></p> <p>NUM02=<ph.num></p> <p>...</p> <p>NUMXX=<ph.num></p> <p>OK</p> <p><ph.num> Phone number enabled to activate maintenance calls</p> <p>Parameter</p> <p>None</p>
<p>Write command AT#CID=[CLIP] NUM<xx>=<ph.num.></p>	<p>This AT command can be used to define or modify up to 4 calling numbers at a time. Definitions shall be separated with commas. Unavailable NUM<xx> fields are appended at the end of the section whereas available NUM<xx> are overwritten by what is defined by the command.</p> <p>Response</p> <p>OK</p> <p>Parameter</p> <p><xx> Index of the field to be defined or modified. This index shall range from 1 to 99 and it shall be expressed by a two-digit decimal number with a zero in front if only one.</p> <p><ph.num.> Phone number to be stored.</p>
<p>Reference Audiotel</p>	<p>Note</p> <p>Command available in the Local and The Remote mode. Enabled users: Supplier and User</p>
<p>Example1</p> <p>Example2</p>	<p>To add/modify a phone number</p> <pre>AT#CID= [CLIP] NUM01=1234567890 OK</pre> <p>Example of a command with a multiple set-up</p> <pre>AT#CID= [CLIP] NUM02=12337456, NUM03=67338735, NUM04=73543345, NUM05=13473756 OK</pre>

8.9 Various commands

8.9.1 AT#VER FW version

Command intended to get information about the current EcoLogger FW version: version number and compilation date/time.

Read command	Response
AT#VER	<prdt_name> <version> <compile_date> OK Parameter <prdt_name> Product name: "Eco Logger" <version> Major and minor numbers intended to identify the current version <compile_date> Compilation date and time
Reference	Note
Audiotel	Command available in the Local and The Remote mode. Enabled users: all
Example	AT#VER Eco Logger Ver. 1.00 22/03/04 11:00 OK

8.9.2 AT#RESET Unit reset

To force the unit to reset completely. The reset is performed at the expiry of the following measuring period. The reset is performed at the expiry of the watch-dog timeout.

Write command	Response
AT#RESET	OK Parameter None
Reference	Note
Audiotel	Command available in the Local and The Remote mode. Enabled users: all
Example	AT#RESET OK
Write command	Variant of the command intended to force an immediate reset, not related to the expiry of the measuring period.
AT#RESET=1	Response OK Parameter Numeric constant: '1'
Reference	Note
Audiotel	Command available in the Local and The Remote mode. Enabled users: all
Example	AT#RESET=1 OK

8.9.3 AT#QUIT Closing a remote maintenance call

Command intended to close a remote maintenance call.

Write command	Response
AT#QUIT	OK Parameter None
Reference	Note
Audiotel	Command available in the Remote mode. Enabled users: all

8.9.4 AT#RTC Clock-Calendar Management

AT command used to read/set up the clock-calendar

Write command	Response
AT#RTC= <yyyy>,<mm>,< dd>,<dwe>,<hh >,<mn>,<sc>	OK Parameter <yyyy> Year expressed by a decimal number <mm> Month, number ranging from 1 to 12 expressed by a decimal number <dd> Month day, number ranging from 1 to 31, expressed by a decimal number <dwe> Week day, number ranging from 1 to 7. 1 corresponds to Monday and 7 to Sunday by convention <hh> Day hour, number ranging from 0 to 23 expressed by a decimal number <mn> Minutes, number ranging from 0 to 59 expressed by a decimal number <sc> Seconds, number ranging from 0 to 59 expressed by a decimal number
Reference	Note
Audiotel	Command available in the Local and The Remote mode. Enabled users: Supplier and User
Example	Set up 12:10:15 on Monday, 22 nd March 2004 AT#RTC=2004,3,22,1,12,10,15 OK
Read command	Response
AT#RTC	<dwe> <yyyy>/<mm>/<dd> <hh>:<mn>:<sc> OK <dwe> Week day expressed by the following mnemonic codes: MON Monday TUE Tuesday WED Wednesday THU Thursday FRI Friday SAT Saturday SUN Sunday <yyyy> Year expressed by a decimal number <mm> Month, number ranging from 1 to 12 expressed by a decimal number <dd> Month day, number ranging from 1 to 31, expressed by a decimal number <hh> Day hour, number ranging from 0 to 23 expressed by a decimal number <mn> Minutes, number ranging from 0 to 59 expressed by a decimal number <sc> Seconds, number ranging from 0 to 59 expressed by a decimal number Parameter None
Reference	Note
Audiotel	Command available in the Local and The Remote mode
Example	To read the current time: 12:10:15 on Monday, 22 nd March 2004 AT#RTC MON 2004/03/22 12:10:15 OK

8.10 AT Commands dedicated to the RF monitor

The commands intended to measure the GSM RF field strenght are listed here below.

	If <n>=2 and there is a change in the ME network registration status or a change of the network cell: +CREG: <stat>[,<lac>,<ci>]	
Reference GSM 07.07	Note Optional parameters will not be displayed during a call.	
Example	AT+CREG=2 OK	Activates extended URC mode.
	AT+COPS=0 OK	Forces ME to automatically search network operator.
	+CREG: 2	URC reports that ME is currently searching.
	+CREG: 1, "0145", "291A"	URC reports that operator has been found.

8.10.2 AT+COPS Operator selection

This command can be used to query the present status of the ME's network registration and to determine whether automatic or manual network selection shall be used.

Automatic mode: Lets the ME automatically search for the home operator. If successful the ME registers to the home network and enters the IDLE mode. If the home network is not found, ME goes on searching. If then a permitted operator is found, ME registers to this operator. If no operator is found the ME remains unregistered.

Manual mode: Desired operator can be manually entered, using the AT+COPS write command syntax. If operator is found, ME registers to this operator. If the selected operator is forbidden, the ME remains unregistered.

Manual/automatic: In this mode, the ME first tries to find the operator that was manually entered. If the ME fails to register to this operator, then it starts to select automatically another network.

Test command
AT+COPS=?
TA returns a list of quadruplets, each representing an operator present in the network. The list of operators is presented in the following order: Home network, networks referenced in SIM, and other networks. Two commas in a succession (,,) are a placeholder for the non-implemented <format>1 (short alphanumeric operator name).

Response

+COPS: (list of supported (<stat>, long alphanumeric <oper>,, numeric <oper>s) [(list of supported <mode>s), (list of supported <format>s)] **OK**

If error is related to ME functionality:

+CME ERROR: <err>

Parameters

<stat>	0	unknown
	1	operator available
	2	current operator (registered)
	3	forbidden operator
<oper>	operator as per <format>	
<mode>	0 - 4	see write command
<format>	0 - 2	see write command

Read command
AT+COPS?
TA returns the current mode and, if registered, the currently used operator. If the ME is unregistered, <format> and <oper> are omitted.

Response

+COPS: <mode>[, <format>[, <oper>]] **OK**

If error is related to ME functionality:

+CME ERROR: <err>

Parameters

See write command

Write command
AT+COPS=
<mode>
[,<format>[,<oper>]]
The write command allows you to choose whether the GSM network operator is to be selected automatically or manually. When using the manual mode, the <operator> must be entered, no matter whether you want to search for the home operator or another one.

Response

OK

	<p>If error is related to ME functionality: +CME ERROR: <err></p> <p>Parameters</p> <p><mode> <u>0</u> automatic mode; <oper> field is ignored 1 manual operator selection 2 <oper> field must be present, <format> can only be = 2 3 manually deregister from network and remain unregistered until 4 mode 0,1,4 is selected 5 set <format> for read command +COPS? 6 combination of manual/automatic mode; 7 if manual selection fails, ME switches to automatic mode 8 (<mode>=0). (<oper> field must be present)</p> <p><oper> operator as per <format></p> <p><format> <u>0</u> long format alphanumeric <oper>; up to 16 characters 2 numeric <oper>; GSM Location Area Identification number</p>
Reference GSM 07.07	Note
Example 1	<p>To query the present status of ME's network registration using the test command: AT+COPS=? +COPS: (2, "D2", , "26202"), (3, "E-Plus", , "26203"), (3, "T-D1", , "26201"), (3, "Interkom", , "26207") , , (0-4), (0,2) OK Registered operator is D2. The other operators are present in the network, but not allowed to be used with the current SIM card.</p> <p>To query the status of the ME's network registration using the read command: AT+COPS? +COPS: 0, 0, "D2" (command returns mode, format, registered operator) OK</p>
Example 2	<p>Attempt to manually select a forbidden operator: AT+COPS=1, 2, 26203 OK</p> <p>If the selected operator was not allowed, the ME is now unregistered. The read command will return only the mode, but no operator: AT+COPS? +COPS: 1</p> <p>In this case, the test command returns only that the desired operator is available (<stat=1). Nevertheless, the registration is not successful. Please use the AT+CREG command (Chapter 8.10.1) to verify the registration status. AT+COPS=? +COPS: (1, "D2", , "26202"), (3, "E-Plus", , "26203"), (3, "T-D1", , "26201"), (3, "Interkom", , "26207") , , (0-4), (0,2) OK AT+CREG? +CREG: 0, 3 (where 3 = registration denied) OK</p>

8.10.3 AT+CSQ Signal quality

Test command AT+CSQ=?	Response +CSQ: (list of supported <rssis>), (list of supported <ber>) OK Parameter See execute command
Execute command AT+CSQ	Response TA returns received signal strength indication <rssis> and channel bit error rate <ber> from the ME. +CSQ: <rssis>, <ber> OK Parameter <rssis> Receive level: 0 -113 dBm or less 1 -111 dBm 2...30 -109... -53 dBm 31 -51 dBm or greater 99 not known or not detectable <ber> Bit error rate: 0...7 as RXQUAL values in the table in GSM 05.08 section 8.2.4. 99 not known or not detectable. To check the bit error rate there must be a call in progress to obtain realistic values. If no call is set up, there is no BER to be determined. In this case the indicated value may be 0 or 99, depending on the SIM card.
Reference GSM 07.07	Note

8.10.4 AT^MONI Monitor idle mode and dedicated mode

Test command	Response
AT^MONI=?	^MONI: (list of supported < period >s) OK
Write command AT^MONI[=<period>]	<p>This command can be used to retrieve information of the serving/dedicated cell <i>automatically</i> every <i>n</i> seconds. It is cancelled by any character sent to serial port except if autobauding is enabled (+IPR=0). Then type character 'a' to abort.</p> <p>Note: The two header lines (see below) are output after every ten data lines.</p> <p>Response SEE EXECUTE COMMAND</p> <p>Parameter <period> 1 – 254 Display period in seconds</p>
Execute command AT^MONI	<p>This command can be used to retrieve the cell parameters of the serving/dedicated cell <i>on request</i>.</p> <p>Note: The length of following output lines exceeds 80 characters. Therefore a terminal program may draw a carriage return on a screen. However, this is not part of the response.</p>

Response (Examples)

ME is not connected:

a) ME is camping on a cell

```
Serving Cell                                I Dedicated channel
chann rs dBm PLMN LAC cell NCC BCC PWR RXLev C1 I chann TS timAdv PWR dBm Q ChMod
1013 21 -71 00101 1001 0103 7 7 33 -105 33 I No connection
```

b) ME camping on a cell, but searching for a better cell (cell reselection)

```
Serving Cell                                I Dedicated channel
chann rs dBm PLMN LAC cell NCC BCC PWR RXLev C1 I chann TS timAdv PWR dBm Q ChMod
1013 4 -106 00101 1001 0103 7 7 33 -105 -1 I in Reselecting
```

c) ME is not camping on a cell and could not (yet) find a suitable cell

```
Serving Cell                                I Dedicated channel
chann rs dBm PLMN LAC cell NCC BCC PWR RXLev C1 I chann TS timAdv PWR dBm Q ChMod
```

ME is connected:

```
Serving Cell                                I Dedicated channel
chann rs dBm PLMN LAC cell NCC BCC PWR RXLev C1 I chann TS timAdv PWR dBm Q ChMod
1013 19 -76 00101 1001 0103 7 7 33 -105 33 I 1015 1 0 5 -76 0 S_HR
```

Parameters

Serving Cell:

chann	ARFCN (Absolute Frequency Channel Number) of the BCCH carrier
rs	RSSI value 0 – 63 (RSSI = Received signal strength indication)
dBm	receiving level of the BCCH carrier in dBm
PLMN	PLMN ID code
LAC	location area code, see note below.
cell	cell ID, see note below.
NCC	PLMN colour code
BCC	base station colour code
PWR	maximal power level used on RACH channel in dBm
RXLev	minimal receiving level (in dBm) to allow registration
C1	coefficient for base station selection

	<p><i>Dedicated channel:</i></p> <p>chann ARFCN (Absolute Frequency Channel Number) of the TCH carrier Note: <chann> = h indicates frequency hopping.</p> <p>TS timeslot number</p> <p>timAdv timing advance in bits</p> <p>PWR current power level</p> <p>dBm receiving level of the traffic channel carrier in dBm</p> <p>Q receiving quality (0–7)</p> <p>ChMod channel mode (S_HR: Half rate, S_FR: Full rate, S_EFR: Enhanced Full Rate)</p>
Reference Siemens	<p>Note</p> <ul style="list-style-type: none"> • The parameters LAC and cell are presented as hexadecimal digits, the remaining parameters are composed of decimal digits. • If the radio cell changes during a connection, the parameters PWR and RXL_{ev} of the ‘Serving Cell’ part cannot be updated under certain conditions and, therefore, are left blank (see also +CREG). This is because the ME does not update the cell selection and reselection parameters since, in this mode, they are not relevant for operation. When the connections ends, and the ME is back to IDLE mode, both parameters will be updated. If the radio cell changes during a connection, it normally takes 1 or 2 seconds to update the parameter cell. Until the Cell ID is received from the new base station, the default value 0000 will be shown instead. • If the BS supports frequency hopping <u>during a connection</u>, the dedicated channel (parameter chann) is not stable. This mode is indicated by chann = ‘h’. • The cell information can be issued in the form of unsolicited result codes (related to <period>), or it can be queried directly using the Execute command AT^MONI. In the first case, the ME activates its RING line (Logic “1”) for one second to send the URC to the connected application. In the second case, the RING line does not change.

8.10.5 AT^MONP Monitor neighbour cells

Test command AT^MONP=?	Response ^MONP: (list of supported < period >s) OK																																																	
Write command AT^MONP=[<period>]	This command can be used to retrieve information of up to six neighbour cells <i>automatically</i> every <i>n</i> seconds. It is cancelled by any character sent to the serial port except if autobauding is enabled (+IPR=0). Then type character 'a' to abort. Response See execute command Parameter <period> 1 – 254 Display period in seconds																																																	
Execute command AT^MONP	This command can be used to obtain information of up to six neighbour cells <i>on request</i> . Response (Example) <table border="1" data-bbox="753 788 1270 1064"> <thead> <tr> <th>chann</th> <th>rs</th> <th>dBm</th> <th>PLMN</th> <th>BCC</th> <th>C1</th> <th>C2</th> </tr> </thead> <tbody> <tr> <td>504</td> <td>18</td> <td>-78</td> <td>26203</td> <td>1</td> <td>27</td> <td>27</td> </tr> <tr> <td>476</td> <td>15</td> <td>-83</td> <td>26203</td> <td>3</td> <td>22</td> <td>22</td> </tr> <tr> <td>421</td> <td>13</td> <td>-88</td> <td>26203</td> <td>1</td> <td>17</td> <td>17</td> </tr> <tr> <td>440</td> <td>10</td> <td>-93</td> <td>26203</td> <td>7</td> <td>12</td> <td>12</td> </tr> <tr> <td>446</td> <td>9</td> <td>-95</td> <td>26203</td> <td>7</td> <td>10</td> <td>10</td> </tr> <tr> <td>417</td> <td>8</td> <td>-97</td> <td>26203</td> <td>4</td> <td>8</td> <td>8</td> </tr> </tbody> </table> OK Parameter: Chann ARFCN (Absolute Frequency Channel Number) of the BCCH carrier rs RSSI value 0 – 63 (RSSI = Received signal strength indication) dBm Receiving level in dBm PLMN PLMN ID code BCC Base Station colour code C1 coefficient for base station selection C2 coefficient for base station reselection	chann	rs	dBm	PLMN	BCC	C1	C2	504	18	-78	26203	1	27	27	476	15	-83	26203	3	22	22	421	13	-88	26203	1	17	17	440	10	-93	26203	7	12	12	446	9	-95	26203	7	10	10	417	8	-97	26203	4	8	8
chann	rs	dBm	PLMN	BCC	C1	C2																																												
504	18	-78	26203	1	27	27																																												
476	15	-83	26203	3	22	22																																												
421	13	-88	26203	1	17	17																																												
440	10	-93	26203	7	12	12																																												
446	9	-95	26203	7	10	10																																												
417	8	-97	26203	4	8	8																																												
Reference Siemens	Note <ul style="list-style-type: none"> • Cell information can be issued in the form of unsolicited result codes (related to <period>), or it can be queried directly using the Execute command AT^MONI. In the first case, the ME activates its RING line (Logic "1") for one second to send the URC to the connected application. In the second case, the RING line does not change. • Due to the fact that not all necessary information of the neighbour cells can be decoded <u>during a connection</u>, there are several constraints to be considered: <ul style="list-style-type: none"> • Only neighbour cells that have already been visible in IDLE mode will be further updated, as long as they are still included in the list. • Though new neighbour cells can be added to the list (e.g. due to handover), their C1 and C2 parameters cannot be displayed until the connection is released. In this case "-" is presented for C1 and C2. 																																																	

8.11 GSM module commands

On top of the commands described above also the AT commands relating to the GSM service may be used. Apply to Electrex to know the details of these commands.

9 FILE FORMAT

9.1 Data File Format (Report File)

The file called *Data File* contains all the information that is required to reconstruct the load profile from the parameters sampled by the *Eco Logger*.

The file is composed by a sequence of records in the ASCII format.

9.1.1 Record format

Each record is composed by the following fields:

#t|dd...d

= Record start character;

t = Character (hex digit) identifying the type of record (0..9A..F);

dd...d = Data field, depending upon the type of record;

| = separator.

9.1.2 Types of records

The following types of records are defined:

0 = Version record;

1 = Header record including fundamental configuration parameters;

2 = Header record including optional configuration parameters;

3 = Data record;

F = Validation record;

9.1.3 Time stamp format

Time is considered as scanned by a one-second resolution in order to reconstruct the time trend of sampled parameters. The *timestamps* used to allocate the various samples temporally have the following format (ISO format):

YYYY-MM-DDT hh:mm:ss±hh:mm

where:

YYYY-MM-DD = date;

hh:mm:ss = time;

±hh:mm = UTC offset;

YYYY = year;

MM = month;

DD = day;

hh = hours (00-24);

mm = minutes;

ss = seconds;

- = separator;

T = separator;

: = separator;

Each day starts at 00:00:00 and it ends at 24:00:00.

The 24:00:00 final instant of each day is identical with the 00:00:00 initial instant of the following one.

9.1.4 File name

The file name derives from the record of type 1 included herein (see later on). The format is as follows:

YYYY-MM-DD_i.rep

where:

YYYY-MM-DD = day that shall be referred to the samples included in the file;

i = identification number (index) of the acquisition channel that shall be referred to the file;

YYYY = year;

MM = month;

DD = day;

The file contains all and only the values that were received from the **i** input during the **YYYY-MM-DD** day, i.e. the *time stamp* of which is in the range between **YYYY-MM-DDT00:00:01** and **YYYY-MM-DDT24:00:00**

9.1.4.1 Version record format (type 0)

The version record format (type 0) is as follows:

#0|ss...s|VVvv

ss...s = signature (ASCII 40 char max string);

VVvv = file version;

VV = major version (1 byte unsigned with hex coding);

vv = minor version (1 byte = 2 hex digit);

| = separator.

Example: #0|ELXREPORT|0100

9.1.5 Header record format (type 1 and type 2)

2 types of header records are available. One of them (type 1) shall compulsorily be available. The other one (type 2) is optional.

The format of the record type 1 is as follows:

#1|YYYY-MM-DD|nn...n|i|tt...t|±hh:mm|pp|ts

YYYY-MM-DD = day that shall be referred to the samples included in the file;

nn...n = instrument name (instrument identifier);

i = identification number (index) of the acquisition channel that shall be referred to the file;

tt...t = time zone name (example: europe\rome)

±hh:mm = time zone (not DST);

hh = hours (00-24);

mm = minutes;

pp = sampling duration in minutes (2 hex digit);

t = type of samples (S = signed integer, U = unsigned integer, R = real);

s = size of samples in bytes (2.4 or 8);

- = separator;

: = separator;
| = separator;

Example: #1|2003-10-25|M8 Test Panel|3|+01:00|0F|R8

The format of the record type 2 is as follows:

#2|qq..q|uu...u|wwwwwwww

qq...q = parameter (name of the sampled parameter);
uu...u = measurement unit of the sampled parameter;
wwwwwwww = weight of the unit (floating point 32bit IEEE754 = 8 hex digit);
| = separator;

Example: #2|Active energy|kWh|3F800000

If the record of type 2 is not available, the fields assumes the following default values:

parameter name = identification number (index) of the acquisition channel that shall be referred to the file;
measurement unit = "pure number";
weight of the unit = 1.0.

9.1.6 Data record format (type 3)

The format of the record type 3 is as follows:

#3t|dd...d

The following fields are defined:

t = character (hex digit) identifying the record subtype (0..9A..F);
dd...d = data field, depending upon the record subtype;
| = separator.

The following subtypes are defined:

0 = sampling scanned by the clock synchronised with the external energy meter;
1 = sampling scanned by the internal clock (RTC);
2 = sampling executed at power on;
3 = sampling executed at power off;
4 = sampling executed at reset;
5 = sampling executed after having regulated the clock synchronised with the external measurer;
6 = sampling executed after having regulated the internal clock (RTC);
7= sampling executed at the DST start or end (Daylight Saving Time);

Format of the record subtype 0:

#30|hh:mm:ss±hh:mm|±hh:mm|v...vv

The following fields are defined:

hh:mm:ss±hh:mm = instant in which the sampling was executed (local time + UTC offset), scanned by the clock synchronised with the external counter;
±hh:mm = offset of the synchronised clock compared to RTC;
v...vv = parameter value at the time of sampling, with hex coding (size and type specified by the record of type 1);

Format of the record subtype 1:

#31|**hh:mm:ss±hh:mm**|**±hh:mm**|**v...vv**

The following fields are defined:

hh:mm:ss±hh:mm = instant in which the sampling has been executed (local time + UTC offset), scanned by the instrument internal clock (RTC);
±hh:mm = RTC offset compared to the clock synchronised with the external counter;
v...vv = parameter value at the time of sampling, with hex coding (size and type specified by the record of type 1);

Format of the record subtype 2:

#32|**hh:mm:ss±hh:mm**|**±hh:mm**|**v...vv**

The following fields are defined:

hh:mm:ss±hh:mm = instant in which the power-on has occurred (local time + UTC offset), given by the instrument internal clock (RTC);
±hh:mm = RTC offset compared to the clock synchronised with the external counter;
v...vv = parameter value at the time of power-on, with hex coding (size and type specified by the record of type 1);

Format of the record subtype 3:

#33|**hh:mm:ss±hh:mm**|**±hh:mm**|**v...vv**

The following fields are defined:

hh:mm:ss±hh:mm = instant in which the power-down has occurred (local time + UTC offset), given by the instrument internal clock (RTC);
±hh:mm = RTC offset compared to the clock synchronised with the external counter;
v...vv = parameter value at the time of power-down, with hex coding (size and type specified by the record of type 1);

Format of the record subtype 4:

#34|**hh:mm:ss±hh:mm**|**±hh:mm**|**v...vv**

The following fields are defined:

hh:mm:ss±hh:mm = instant in which the reset has occurred (local time + UTC offset), given by the instrument internal clock (RTC);
±hh:mm = RTC offset compared to the clock synchronised with the external counter;
v...vv = parameter value at the time of power-down, with hex coding (size and type specified by the record of type 1);

Format of the record subtype 5:

#35|**hh:mm:ss±hh:mm**|**±hh:mm**|**YYYY-MM-DDT hh:mm:ss**|**v...vv**

The following fields are defined:

hh:mm:ss±hh:mm = instant in which the synchronised clock has been regulated (local time + UTC offset), given by the instrument internal clock (RTC);

±hh:mm = RTC offset compared to the clock synchronised with the external counter (before the regulation);

YYYY-MM-DDThh:mm:ss = New set-up of the synchronised clock;

v...vv = parameter value at the time of the regulation of the synchronised clock, with hex coding (size and type specified by the record of type 1);

Format of the record subtype 6:

#36|hh:mm:ss±hh:mm|±hh:mm|YYYY-MM-DDThh:mm:ss|v...vv

The following fields are defined:

hh:mm:ss±hh:mm = instant in which RTC has been regulated (local time + UTC offset), given by RTC itself (before the regulation);

±hh:mm = RTC offset compared to the clock synchronised with the external counter (before the regulation);

YYYY-MM-DDThh:mm:ss = New RTC set-up;

v...vv = parameter value at the time of the RTC regulation, with hex coding (size and type specified by the record of type 1);

Format of the record subtype 7:

#37|hh:mm:ss±hh:mm|±hh:mm|YYYY-MM-DDThh:mm:ss|v...vv

The DST start or end will cause RTC to adjust.

The following fields are defined:

hh:mm:ss±hh:mm = instant in which RTC has been regulated (local time + UTC offset), given by RTC itself (before the regulation);

±hh:mm = RTC offset compared to the clock synchronised with the external counter (before the regulation);

YYYY-MM-DDThh:mm:ss = New RTC set-up;

v...vv = parameter value at the time of the RTC regulation, with hex coding (size and type specified by the record of type 1);

9.1.7 Validation record format (type F)

The format of the record type F is as follows:

#F|nnnn|cccc

The following fields are defined:

nnnn = number of records in the file (1 word = 4 hex digit);

cccc = CRC-CCITT (calculated only on the characters composing the records, up to the character before CRC and by leaving out CR, LF or any space between the end of a record and the start of the following one).

9.2 System configuration file format (config.ini)

9.2.1 Purpose

The config.ini file includes many types of parameters that are of fundamental importance for the operation of the unit.

9.2.2 Structure

The system configuration file structure is the same of the Windows .ini configuration files. In particular, the file is divided into sections including one or more than one field.

9.2.3 Sections

Field name	Description
[Header]	Section intended to include general information about the unit
[Input#]	Section with fields only intended to describe the measurements that have been taken on each sensor. There shall be a [Input#] section for each sensor managed by the unit. A unit with 4 sensors shall have a config.ini with 4 sections from [Input1] to [Input4].

9.2.3.1 [Header] section

Field name	Description
Ver=<major>,<minor>	Configuration file version: <major> couple of numeric digits corresponding to the most significant version number. <minor> couple of numeric digits corresponding to the least significant version number.
Signature=<...>	String identifying the currently active FW version
Id=<unit_name>	Mnemonic term associated with the unit
Timezonename=<...>	String describing the selected time zone. (E.g. "Europe/Rome")
Timezone=±HH:MM	Time zone
Sampleperiod=<minutes>	Duration of the Demand integration period. <minutes> can assume one of the following values 5 – 10 – 15 – 20 – 30 – 60
Dst=±HH:MM	Daylight Saving Time. <i>Temporary parameter, waiting for a more specific implementation</i>

9.2.3.2 [Input#] section

Field name	Description
Parameter=<...>	Name of the measured parameter (Current, Power...)
Unit=<...>	Measurement unit expressing the executed count (Kwh, Volt...)
Factor=<factor>	Multiplying factor to be applied to collected counts. <factor> decimal number specifying the multiplying factor to be applied to counters
Size=<type><size>	Size and features of the counts:

	<type> single character describing the type of data item represented by counters: U unsigned integer S signed integer R floating-point number
	<size> numeric digit expressing the counter size in bytes: 2 Word 4 Double Word or single float

9.3 config.ini example

```
[Header]
Ver=01.00
Id=Eco Logger
Timezone=+01:00
Dst=+00:00
Sampleperiod=5
Syncwindow=5
```

```
[Input1]
Parameter=Power
Unit=kWh
Factor=1
Size=U2
```

```
[Input2]
Parameter=Active energy
Unit=kWh
Factor=1
Size=U2
```

9.4 Daylight Saving Time management file format (dst_cal.ini)

9.4.1 Purpose

The *dst_cal.ini* file is intended to update the internal clock automatically when switching from the true solar time to the daylight saving time and vice versa.

9.4.2 Structure

The system configuration file structure is the same of the Windows .ini configuration files. In particular, the file is divided into sections including one or more than one field.

9.4.3 Sections

The *dst_cal.ini* file includes sections called **[YearYYYY]** containing the date and time of each change for the YYYY year. Each year can generally provide for two changes only. A leap-second can be generally balanced by a third change.

9.4.3.1 Section [YearYYYY]

Field name	Description
Change01=MM-DDThh:mm:ss±hh:mm	Change date and time expressed as LocalTime and UTC
Bias01=±hh:mm:ss	Bias to be added to the time at the time of the change
Flag01=STDT/DLST	Regime description after the change (STDT=true solar time, DLST= daylight saving time)
Change02=MM-DDThh:mm:ss±hh:mm	Change date and time expressed as LocalTime and UTC
Bias02=±hh:mm:ss	Bias to be added to the time at the time of the change
Flag02=STDT/DLST	Regime description after the change (STDT=true solar time, DLST=daylight saving time)

9.4.4 Example

```
[Year2004]
Change01=03-28T02:00:00+01:00
Bias01=+01:00:00
Flag01=DLST
Change02=10-31T03:00:00+02:00
Bias02=-01:00:00
Flag02=STDT
```

```
[Year2005]
Change01=03-27T02:00:00+01:00
Bias01=+01:00:00
Flag01=DLST
Change02=10-30T03:00:00+02:00
Bias02=-01:00:00
Flag02=STDT
```

9.5 power.log file specification

9.5.1 Purpose

The power.log file contains all the types of events related to the power supply of the unit.

9.5.2 Structure

The power.log file is a simple text file. Each event is represented by a line of characters ending with a carriage return and line feed.

Each line includes a time stamp in the dd/mm/yyy hh:mm:ss format as well as a mnemonic description about the event that occurred.

After having reached the size of 1024 bytes, the power.log file is renamed as power.log.1 and the most recent event is inserted into a new power.log file.

The description of the fields and the list of the values they may assume are given here below:

power.log file

Field name	Description
[Date]	event date in the dd/mm/yyyy format
[Time]	event time in the hh:mm:ss format
[Event]	string intended to describe the event. It may assume the "POWER ON" or "POWER FAIL" values for the power.log file.

9.5.3 Example

Example for the content of a power.log file:

```
20-04-2004 14:17:17 POWER ON
20-04-2004 14:21:50 POWER FAIL
20-04-2004 14:26:47 POWER ON
```

9.6 calls.log file specification

9.6.1 Purpose

The calls.log file contains all the types of events about the remote incoming calls received by the unit.

9.6.2 Structure

The calls.log file is a simple text file. Each event is represented by a line of characters ending with a carriage return and line feed.

Each line includes a time stamp in the dd/mm/yyyy hh:mm:ss format as well as a mnemonic description about the incoming calls received.

Whenever an incoming call is accepted, an additional line will follow the one including the calling number. It shows the type of connected user after the latter has successfully passed the login phase.

The file signals whether the user entered no password in the login phase or whether it unsuccessfully made all the entry attempts at its disposal.

After having reached the size of 1024 bytes, the calls.log file is renamed as calls.log.1 and the most recent event is inserted into a new calls.log file.

The description of the fields and the list of the values that they may assume are given here below:

calls.log file

Field name	Description
[Date]	event date in the dd/mm/yyyy format
[Time]	event time in the hh:mm:ss format
[Incoming Number]	phone number that called the Eco Logger, including the international dialling code, preceded by the "Receiving" string and followed by the acceptance or non-acceptance of the call with the "Answered" or "Rejected" indications according to the circumstances. (Not available in the line intended to describe the login result)
[Event]	string describing the event. It may assume the following values for the calls.log file: "Logged as User": if the user logged in with the User profile "Logged as Maintainer": if the user logged in with the Maintainer profile "Password Time Out": in case of time out for the correct password entry "Password Error": in case the attempts allowed for the the correct password entry are executed

9.6.3 Example

Example for the content of a calls.log file:

```

20-04-2004 15:19:47 Receiving +391234567890 Answered
20-04-2004 15:19:47 Logged as Supplier
20-04-2004 15:29:37 Receiving +390987654321 Answered
20-04-2004 15:29:43 Logged as User
20-04-2004 15:31:04 Receiving +391234567890 Rejected
20-04-2004 15:32:28 Receiving +391122335566 Answered
20-04-2004 15:32:36 Logged as Maintainer
20-04-2004 15:44:16 Receiving +397788994411 Answered
20-04-2004 15:45:50 Password Error
20-04-2004 15:49:01 Receiving +391111111111 Answered
20-04-2004 15:49:31 Password Time Out
    
```

9.7 events.log file specification

9.7.1 Purpose

The events.log file contains all the types of events about the changes that were made to the configuration and downloading files of a new firmware in order to update the unit.

An error message is also written in the events.log file if the microprocessor can not activate the communication with the measurement engine measuring engine at start-up.

9.7.2 Structure

The events.log file is a simple text file. Each event is represented by a line of characters ending with a carriage return and line feed.

Each line includes a time stamp in the dd/mm/yyy hh:mm:ss format as well as a mnemonic description about the event that has occurred.

Any change that may be made to the configuration file by means of the AT#WRITE command is traced inside the file.

A notification is added to the file whenever a new firmware is transferred to the instrument by means of the AT#WRITE command.

A notification is added to the file if the measurement engine engine should not answer the microprocessor query at the start-up.

After having reached the size of 1024 bytes, the events.log file is renamed as events.log.1 and the most recent event is inserted into a new events.log file.

The description of the fields and the list of the values they may assume are given here below:

events.log file

Field name	Description
[Date]	event date in the dd/mm/yyyy format
[Time]	event time in the hh:mm:ss format
[Event]	string intended to describe the event. It may assume the following values for the events.log file: <ul style="list-style-type: none"> “Written config.ini file”: if a new config.ini file was written “Written dst_cal.ini file”: if a new dst_cal.ini file was written “Written password.cfg file”: if a new password.cfg file was written “Written indust.cid file”: if a new indust.cid file was written “Written INDPLUS.OS7 file”: if a new file was written to update the fw “Written indust.ini file”: if a new indust.ini file was written “Communication with the measurement engine failed”: If communication with the measurement engine at power on failed to be established.

9.8 Example

Example for the content of an events.log file:

```

20-04-2004 14:27:11 Written config.ini file
20-04-2004 14:35:57 Written dst_cal.ini file
20-04-2004 14:37:31 Written password.cfg file
20-04-2004 14:42:13 Written indust.cid file
20-04-2004 14:48:02 Written INDPLUS.OS7 file
20-04-2004 15:01:52 Written indust.ini file
20-04-2004 15:03:26 Communication with the measurement engine engine failed
    
```

10 MODBUS protocol

The ModBus protocol is used to programme the measurement engine and to read the parameters.

The ASCII format is used as follows.

10.1 The ASCII Transmission Mode

When units are set-up to communicate on a MODBUS serial line using ASCII (American Standard Code for Information Interchange) mode, each 8-bit byte in a message is sent as two ASCII characters. This mode is used when the physical communication link or the capabilities of the unit does not allow the conformance with RTU mode requirements regarding imers management.

Remark : this mode is less efficient than RTU since each byte needs two characters.

Example : The byte 0X5B is encoded as two characters : 0x35 and 0x42 (0x35 ="5", and 0x42 ="B" in ASCII).

The format for each byte (10 bits) in ASCII mode is :

Coding System: Hexadecimal, ASCII characters 0–9, A–F
 One hexadecimal character contains 4-bits of data within each ASCII character of the message

Bits per Byte: 1 start bit
 7 data bits, least significant bit sent first
 1 bit for parity completion;
 1 stop bit

Remark : the use of no parity requires 2 stop bits.

How Characters are Transmitted Serially :

Each character or byte is sent in this order (left to right):
 Least Significant Bit (LSB) . . . Most Significant Bit (MSB)

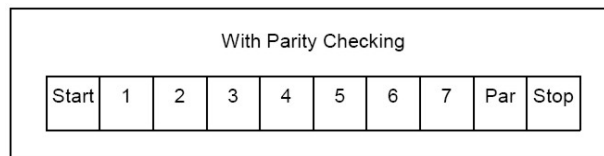


Figure 15: Bit Sequence in ASCII mode

Units may accept by configuration either Even, Odd, or No Parity checking. If No Parity is implemented, an additional stop bit is transmitted to fill out the character frame :

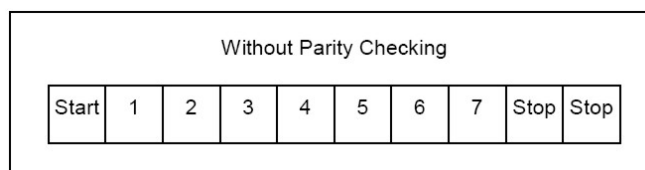


Figure 16: Bit Sequence in ASCII mode (specific case of No Parity)

Frame Checking Field: Longitudinal Redundancy Checking (LRC)

10.2 MODBUS Message ASCII Framing

A MODBUS message is placed by the transmitting unit into a frame that has a known beginning and ending point. This allows units that receive a new frame to begin at the start of the message, and to know when the message is completed. Partial messages must be detected and errors must be set as a result.

The address field of a message frame contains two characters.

In ASCII mode, a message is delimited by specific characters as Start-of-frames and End-of-frames. A message must start with a **'colon'** (:) character (ASCII 3A hex), and end with a **'carriage return – line feed'** (CRLF) pair (ASCII 0D and 0A hex).

The allowable characters transmitted for all other fields are hexadecimal 0–9, A–F (ASCII coded). The units monitor the bus continuously for the 'colon' character. When this character is received, each unit decodes the next character until it detects the End-Of-Frame.

Intervals of up to one second may elapse between characters within the message. Unless the user has configured a longer timeout, an interval greater than 1 second means an error has occurred. Some Wide-Area-Network application may require a timeout in the 4 to 5 second range.

A typical message frame is shown below.

Start	Address	Function	Data	LRC	End
1 char :	2 chars	2 chars	0 up to 2x252 char(s)	2 chars	2 chars CR,LF

ASCII Message Frame

10.3 LRC Checking

In ASCII mode, messages include an error-checking field that is based on a Longitudinal Redundancy Checking (**LRC**) calculation that is performed on the message contents, exclusive of the beginning 'colon' and terminating CRLF pair characters. It is applied regardless of any parity checking method used for the individual characters of the message. The LRC field is one byte, containing an 8-bit binary value. The LRC value is calculated by the unit that emits, which appends the LRC to the message. The unit that receives calculates an LRC during receipt of the message, and compares the calculated value to the actual value it received in the LRC field. If the two values are not equal, an error results.

The LRC is calculated by adding together successive 8-bit bytes of the message, discarding any carries, and then two's complementing the result. It is performed on the ASCII message field contents excluding the 'colon' character that begins the message, and excluding the CRLF pair at the end of the message. In ASCII mode, the resulting LRC is ASCII encoded into two bytes and placed at the end of ASCII mode frame prior to the CRLF.

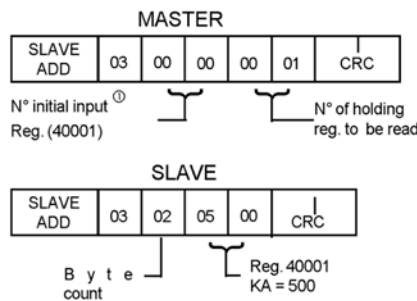
10.4 AVAILABLE MODBUS FUNCTIONS

- read holding register (3)
- read input register (4)
- preset single register (6)
- read exception status (7)
- report slave id (17)

10.4.1 Read holding register (3)

(registers in the BCD format)

Function intended to read the registers used to programme the operation of the instruments. The registers are programmed with the "preset single register" (6) function.



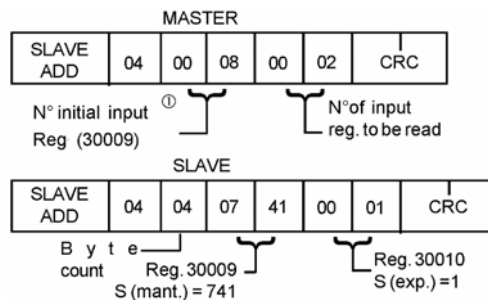
LIST OF HOLDING REGISTERS

40001 - KA (current transformer ratio: from 1 to 9999)

10.4.2 Read input register (4)

Registers in the IEEE Little Endian format.

This function is intended to read the registers where the measurements have been stored.

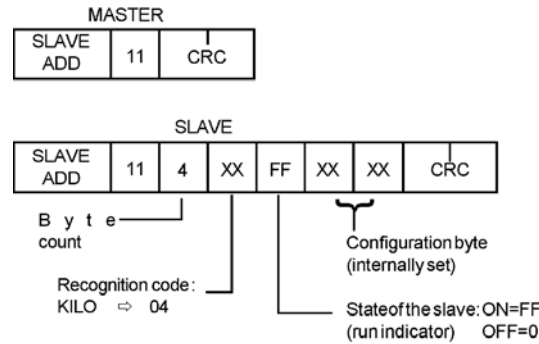


LIST OF INPUT REGISTERS

30001 (V)	1 st part of the data item	30002 (V)	2 nd part of the data item
30003 (I)	"	30004 (I)	"
30005 (P)	"	30006 (P)	"
30007 (Q)	"	30008 (Q)	"
30009 (S)	"	30010 (S)	"
30011 (PF)	"	30012 (PF)	"
30021	first part of the Active Energy meter count		

10.4.5 Report slave id (17)

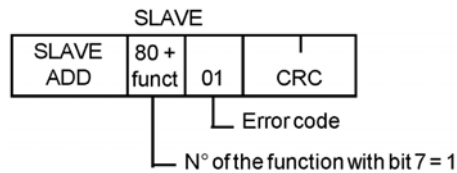
This function is intended to identify the instrument by assigning it a recognition code.



The communication errors are detected by the slave and managed by the instrument in two ways:

1) “no answer”: error in the data format, CRC, etc. (it is not sure that the message has been addressed correctly). No re-attempt of transmission to the same slave may be made before the expiry of a 3 sec. time-out after the transmission of the last byte.

2) “exception response”



The possible error codes are:

- 01 - illegal function
- 02 - illegal data address
- 03 - illegal data value

Possible error codes are:

- 01 - illegal function
- 02 - illegal data address
- 03 - illegal data value

11 REFERENCE DOCUMENTATION

The operation of the Eco Logger in the PLMN network is in compliance with the following ETSI specifications:

- [1]ETSI GSM 07.05 : *European digital cellular telecommunication system (phase 2) ; Use of DTE-DCE interface for Short message service and cell broadcast service*
- [2]ETSI GSM 07.07 : *European digital cellular telecommunication system (phase 2) ; AT command set for GSM Mobile Equipment*
- [3]ITU-T Recommendation V.25 ter : *Serial asynchronous automatic dialling and control*
- [4]ETSI GSM 03.40 : *European digital cellular telecommunication system (phase 2)*
- [5]ETSI GSM 03.38 : *European digital cellular telecommunication system (phase 2) ; Alphabets and language-specific information*
- [6]MODBUS over Serial Line *Specification & Implementation guide V1.0*

11.1 DEFINITIONS

A call from a GSM mobile to the PLMN network is defined as a “mobile originated call” or an “outgoing call” whereas a call from the fixed network to a GSM mobile is defined as a “mobile terminated call” or an “incoming call” according to the GSM terminology.

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Latest revision 06/2004

Code 0808X081000E1